

Life Cycle Impact of forestry for bioenergy generation in Norway, including effects on carbon stocks and biodiversity from land use and land use changes

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'The forest(ry) life cycle'



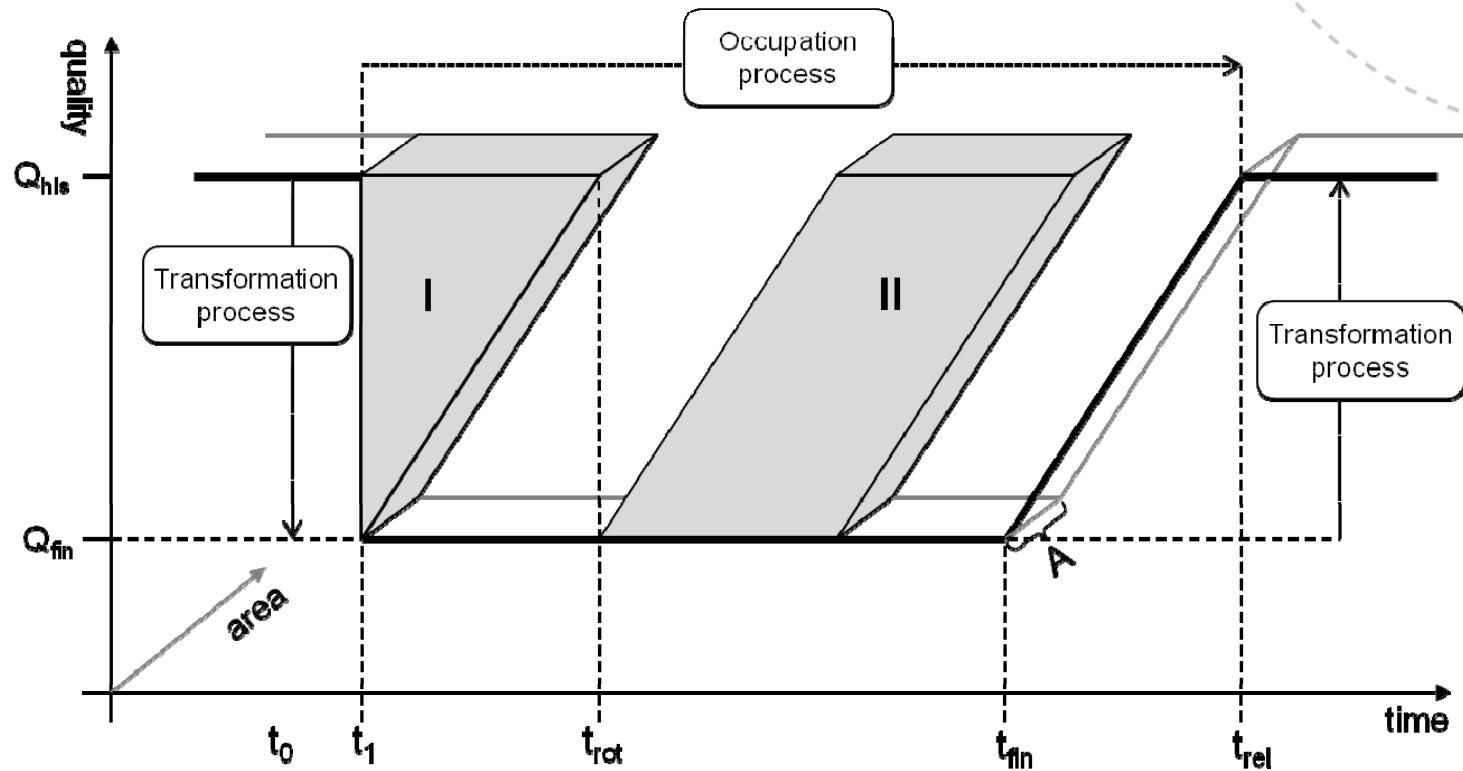
Silviculture



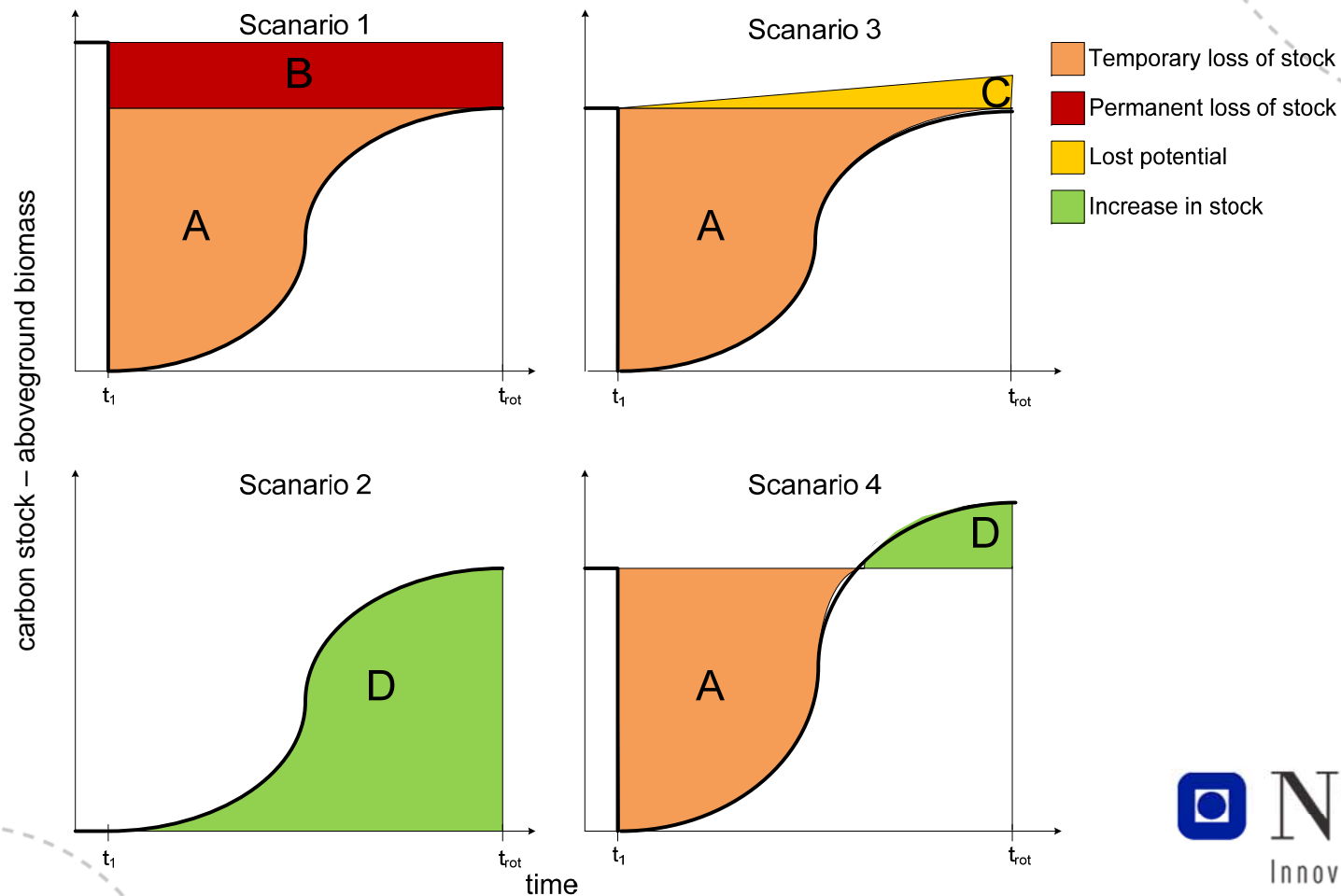
Included scenarios

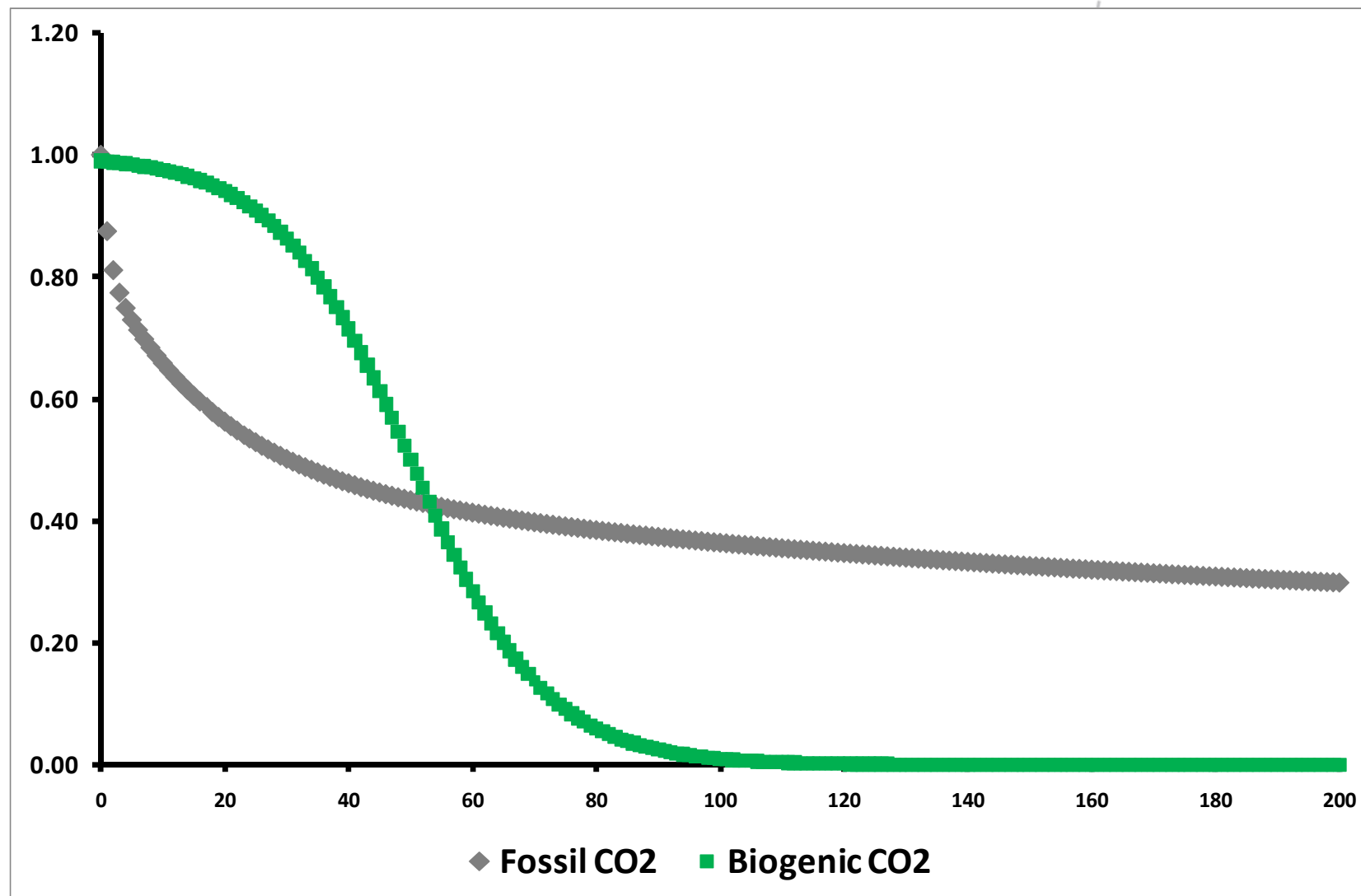
	Initial volume m^3ha^{-1}		Final volume m^3ha^{-1}	Logged volume m^3
1	272	Logging – transformation from a unmanaged to a managed forest with Norway spruce	218	272
2	0	Establishment of a managed forest with Norway spruce on fallow land	218	0
3	218	Logging, continuous rotations with Norway spruce	218	218
4	218	Logging, continuous rotations where Norway spruce is replaced with Sitka spruce	294	218

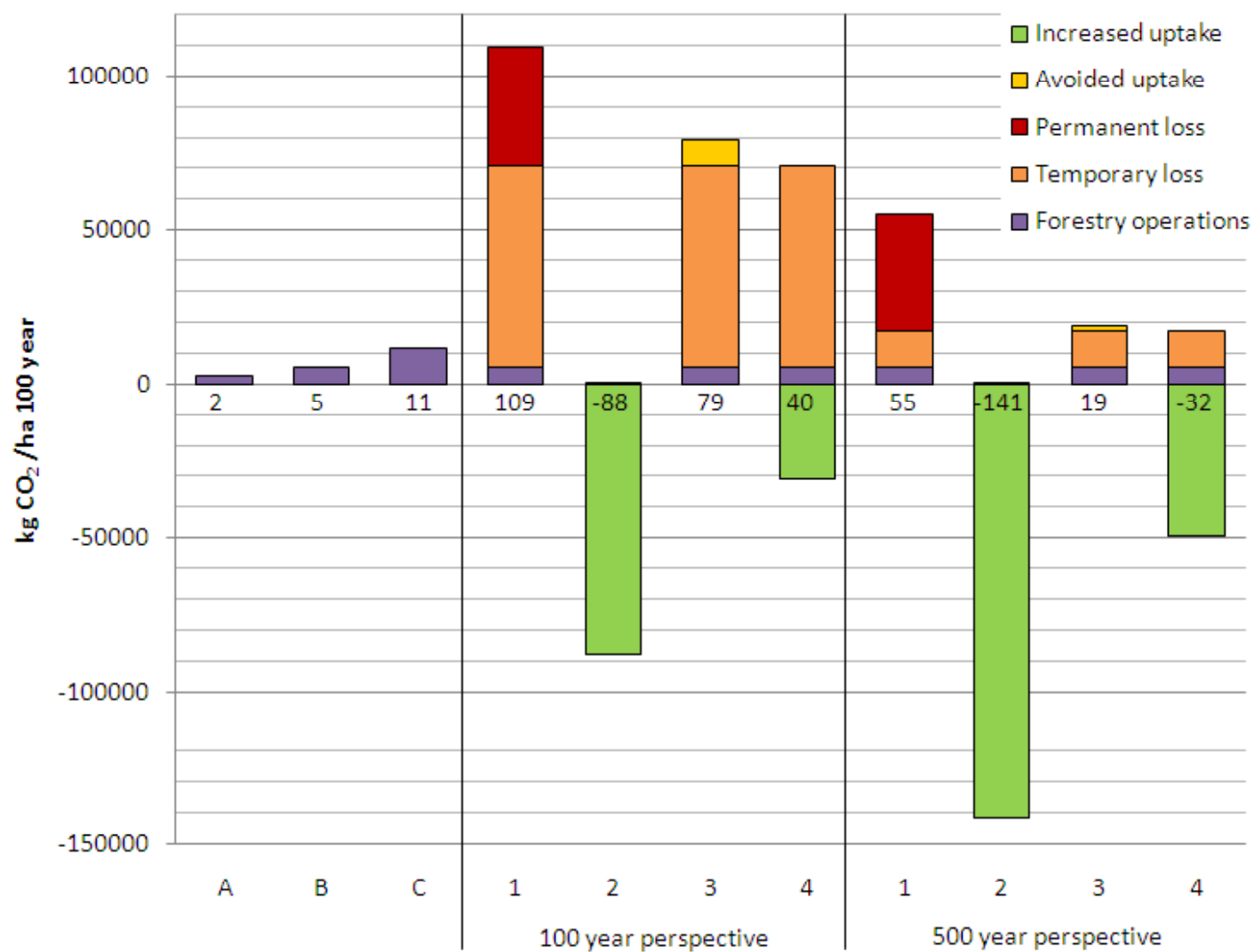
Impact from LULUC



Changes in carbon pools







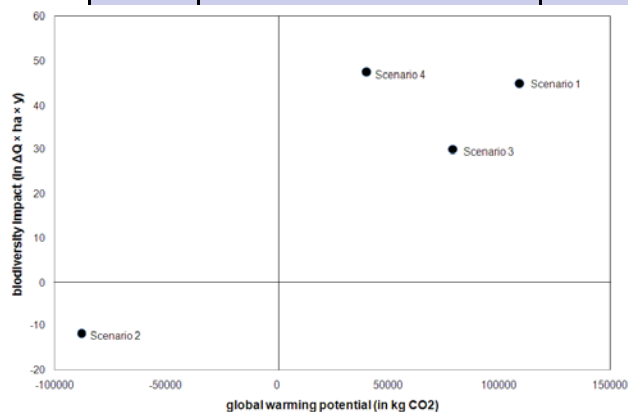
Impact on biodiversity

- Based on a proposed methodology described in Michelsen (2008)
- Indirect measures on biodiversity value based on
 - Ecosystem scarcity
 - Ecosystem vulnerability
 - Conditions for maintained biodiversity
 - Area set aside
 - Introduced species
 - Amount of decaying wood

$$CMB = 1 - \frac{\sum_{i=1}^n KF_i}{\sum_{i=1}^n KF_{i,max}}$$

Impact allocated to production

	GWP (kg CO ₂)		Impact on biodiversity (ΔQ×ha×y)	
	1 ha 100 year	1m ³ round wood	1 ha 100 year	1m ³ round wood
1	109,093	401	45.00	0.17
2	-87,581	NA	-11.75	NA
3	79,166	363	30.00	0.14
4	40,356	185	47.60	0.22



Conclusions

- Methodology for assessing impacts from LULUC is still immature and results uncertain
- Impact from LULUC is of major importance
- Time perspective is of major importance
 - Impact of biogenic CO₂ emissions is favoured by long time perspectives
 - Do you plant a forest before you log it, or do you log a forest before you plant it?
 - Allocation of transformation impact
- Biomass production ratios impose uncertainties
 - Growth rates – species and site differences
 - Wood densities – wide ranges
- LULUC is complex in itself - different perspectives give different results